

te technical note techn

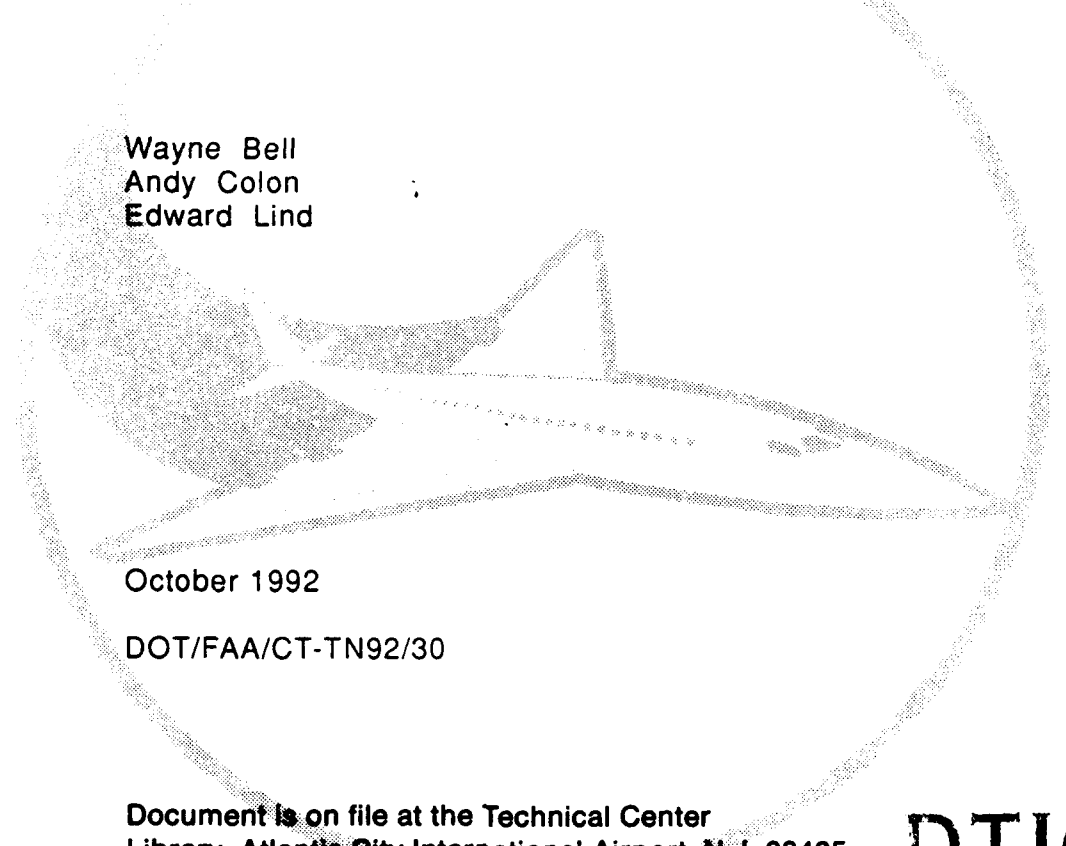
2

AD-A257 891



# High Capacity Voice Recorder (HCVR) Operational Test and Evaluation (OT&E) Integration Test Report

Wayne Bell  
Andy Colon  
Edward Lind



October 1992

DOT/FAA/CT-TN92/30

Document is on file at the Technical Center  
Library, Atlantic City International Airport, N.J. 08405

DTIC  
ELECTE  
NOV 16 1992  
S E D



U.S. Department of Transportation  
Federal Aviation Administration

Technical Center  
Atlantic City International Airport, N.J. 08405

711 863  
92-29554



92 98

### **NOTICE**

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.

# Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN92/30	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle HIGH CAPACITY VOICE RECORDER (HCVR) OPERATIONAL TEST AND EVALUATION (OT&E) INTEGRATION TEST REPORT		5. Report Date October 1992	
		6. Performing Organization Code	
7. Author(s) Wayne Bell, Andy Colon, Edward Lind		8. Performing Organization Report No. DOT/FAA/CT-TN92/30	
9. Performing Organization Name and Address Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Atlantic City International Airport, NJ 08405		13. Type of Report and Period Covered  Technical Note	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract  <p>This report describes the Operational Test and Evaluation (OT&amp;E) Integration tests performed by ACW-400A on the High Capacity Voice Recorder (HCVR) equipment. This Commercial Off-The-Shelf (COTS) equipment is being acquired to replace existing 152-channel voice recorders currently in use at Air Route Traffic Control Centers (ARTCCs) and the New York Terminal Radar Approach Control (TRACON) Facility.</p> <p>Tests to verify FAA-P-2878 (Purchase Description) requirements were performed at the Federal Aviation Administration (FAA) Technical Center. Tests to verify NAS-SS-1000, Volume I, System Level Requirements, and Volume IV, Subsystem Level Requirements were performed at the Seattle ARTCC (the designated key test site).</p> <p>This equipment did not meet all FAA-P-2878 or NAS-SS-1000 requirements, primarily because it is COTS equipment and was not specifically designed to meet FAA requirements. The advantages of this equipment, however, outweigh the disadvantages, in the opinion of ACW-400A. The HCVR equipment is, therefore, recommended for deployment under the conditions cited in this report.</p>			
17. Key Words  High Capacity Voice Recorder (HCVR) Voice recording Peak limiter		18. Distribution Statement  Document is on file at the Technical Center Library, Atlantic City International Airport, NJ 08405	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 43	22. Price

## TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	v
1. INTRODUCTION	1
1.1 Background	1
1.2 Purpose	1
1.3 Participants	1
1.4 Reference Documents	2
2. TEST APPROACH AND CONCEPT	2
3. TESTS AT FAA TECHNICAL CENTER	2
3.1 Unit Level Tests	2
3.2 Drop-out Tests	5
3.3 Audio Input Level Tests	6
4. OT&E INTEGRATION TESTS AT KEY SITE	8
4.1 System Level Requirements Verification Test	8
4.2 Subsystem Level Requirements Verification Test	8
5. CONCLUSIONS	11
5.1 Unit Level Test Conclusions	11
5.2 Drop-out Test Conclusions	11
5.3 Peak Limiter Test Conclusions	11
5.4 OT&E Integration Test Conclusions	11
6. RECOMMENDATIONS	12
7. ACRONYMS AND ABBREVIATIONS	12
APPENDIXES	
A - FAA-P-2878 Verification Requirements and Final Report Traceability Matrix	
B - NAS-SS-1000 Volume I, System Level Requirements	
C - NAS-SS-1000 Volume IV, Subsystem Level Requirements	
D - Peak Limiter Test Results	

# LIST OF ILLUSTRATIONS

Figure		Page
1	Unit Level Test Configuration	3
2	Audio Input Level Test	7
3	Plot of Peak Limiter Output Data	9

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification .....	
By .....	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

QUALITY INSPECTED 4

## EXECUTIVE SUMMARY

The Magnasync Specialist 60-Channel Recorder/Reproducer is being acquired for the High Capacity Voice Recorder (HCVR) Program as a Commercial-Off-The-Shelf (COTS) replacement for the existing 152-channel voice recorders currently used at Air Route Traffic Control Centers (ARTCCs) and the New York Terminal Radar Approach Control Facility (TRACON).

During testing at the Federal Aviation Administration (FAA) Technical Center and at the key test site at the Seattle ARTCC, it was found that this equipment did not meet all FAA-P-2878 (Purchase Description) requirements. The requirements which failed are all categorized as noncritical, based on the definition of "Critical" in NAS-SS-1000, Volume I, Section 6, page 106; "Functions or services that, if lost, would prevent the NAS from exercising safe separation and control over aircraft."

It must be noted that this equipment is COTS equipment and was not specifically designed to meet all HCVR FAA-P-2878 requirements.

This procurement provides the following advantages:

1. Reduction in power consumption from 1.158 kilowatts (kW) to 991.5 watts (w), for the 300-channel system at the Seattle ARTCC,
2. Increased recording capacity from 152 channels to 300 channels, for Seattle ARTCC,
3. Increased reliability and reduced maintenance due to solid state modular design,
4. Head replacement period increased from 4 months for present recorders, to 3 years for Magnasync recorders,
5. Standard 10 1/2" tape reels as opposed to special reels for 152-channel recorder, and,
6. Commercially available replacement parts as opposed to specially machined parts for 152-channel recorder.

There are the following areas of concern;

1. This equipment cannot presently interface with a modified Inter-Range Instrumentation Group version E (IRIG-E) coded time source at the Seattle site.
2. The equipment exceeds the Total Harmonic Distortion voltage (THDv) requirement of the critical alternating current (AC) power bus.

An Engineering Change Proposal (ECP) is one of the options being considered to resolve the coded time source problem and a NAS Change Proposal (NCP) is in process for a waiver on the THDv requirement.

The advantages, in the opinion of ACW-400A, outweigh the disadvantages.

Deployment is recommended with the conditions noted in section 6 of this report.

## 1. INTRODUCTION.

This test report details the results of the High Capacity Voice Recorder (HCVR), Commercial Off-The-Shelf (COTS) equipment, Operational Test and Evaluation (OT&E) testing performed at the Federal Aviation Administration (FAA) Technical Center in April and May 1992, and at Seattle Air Route Traffic Control Center (ARTCC) (ZSE), the key test site, in May and June 1992.

### 1.1 BACKGROUND.

The HCVR is a 60-channel recorder/reproducer COTS replacement for the existing 152-channel voice recorders currently used at ARTCCs and the New York Terminal Radar Approach Control Facility (TRACON). Procurement of 60-channel recording equipment to replace existing aging units will assist in the modernization of ARTCCs and the New York TRACON, thereby improving the overall performance of the National Airspace System (NAS).

### 1.2 PURPOSE.

The HCVR is used for recording of all air-to-ground (a-g) and selected ground-to-ground (g-g) voice communications. The HCVR equipment will interface with existing communications systems to continuously record a-g and g-g voice communications and provide for monitoring, automated retrieval, and high speed reproduction of any recorded voice communications. The HCVR equipment consists of a dual transport recorder/reproducer system and a portable reproducer system.

### 1.3 PARTICIPANTS.

The OT&E Integration team for the HCVR equipment evaluation was composed of personnel from the Communications Test Team (ACW-400) of the FAA Technical Center for the unit level tests and personnel from ACW-400A and the Seattle ARTCC for the key site tests. The personnel involved are listed below.

#### 1.3.1 FAA Technical Center.

<u>NAME</u>	<u>ORGANIZATION</u>
Wayne Bell	ACW-400A
Edward Lind	ACW-400A
Andy Colon	ACW-400A
Benjamin Gottlieb	ACW-400A
Rich Morton	ACW-400A

#### 1.3.2 Seattle ARTCC

<u>NAME</u>	<u>ORGANIZATION</u>
Rachel Ayers	ZSE-TSO
Bob Carter	ZSE-NCO
T.J. Conrad	ZSE-RDC
Gary Weiler	ZSE-RDC

## 1.4 REFERENCE DOCUMENTS.

- |    |                           |   |
|----|---------------------------|---|
| a. | FAA-STD-024A              | Preparation of Test and Evaluation Documentation.   |
| b. | NAS-SS-1000               | NAS System Specification, Functional and Performance Requirements for the National Airspace System. |
| c. | FAA Order 1810.4B         | FAA Test and Evaluation Program.  |
| d. |                           | HCVR-NAS System Performance Test Procedures.  |
| e. |                           | HCVR-NAS System Integration Test Procedures.  |
| f. | FAA-P-2878                | 60 Channel Voice Recording and Playback Equipment Purchase Description                              |
| g. | ANSI S3.2-1960<br>(R1971) | USA Standard Method for Measurement of Monosyllabic Word Intelligibility                            |

## 2. TEST APPROACH AND CONCEPT.

The test approach was to operationally evaluate and integrate the HCVR equipment provided by Magnasync/Moviola Corporation of Hollywood, CA, to operationally evaluate and integrate the HCVR equipment into the NAS. This was accomplished by unit level tests at the FAA Technical Center and System Integration tests at the Seattle ARTCC. In order not to delay implementation of the HCVR project, these tests were conducted with the following known problems:

- a. Equipment cannot operate with a modified IRIG-E coded time source,
- b. Equipment exceeds NAS-SS-1000, Volume VI, paragraph 3.2.1.5.4.1.2.3b Total Harmonic Distortion voltage (THDv) requirement.

## 3. TESTS AT FAA TECHNICAL CENTER.

Three areas of tests were conducted at the FAA Technical Center; unit level tests, drop-out tests and audio input level tests. Each are discussed in the following paragraphs.

### 3.1 UNIT LEVEL TESTS.

Unit level tests were performed on the Magnasync Specialist 60-Channel Recorder/Reproducer, portable Reproducer and Degausser, to verify FAA-P-2878 Requirements (appendix A); selected NAS-SS-1000 Volumes I, System Level Requirements (appendix B); and selected NAS-SS-1000, Volume IV, Subsystem Level Requirements (appendix C). A block diagram of the test configuration of the unit level tests is provided in figure 1.



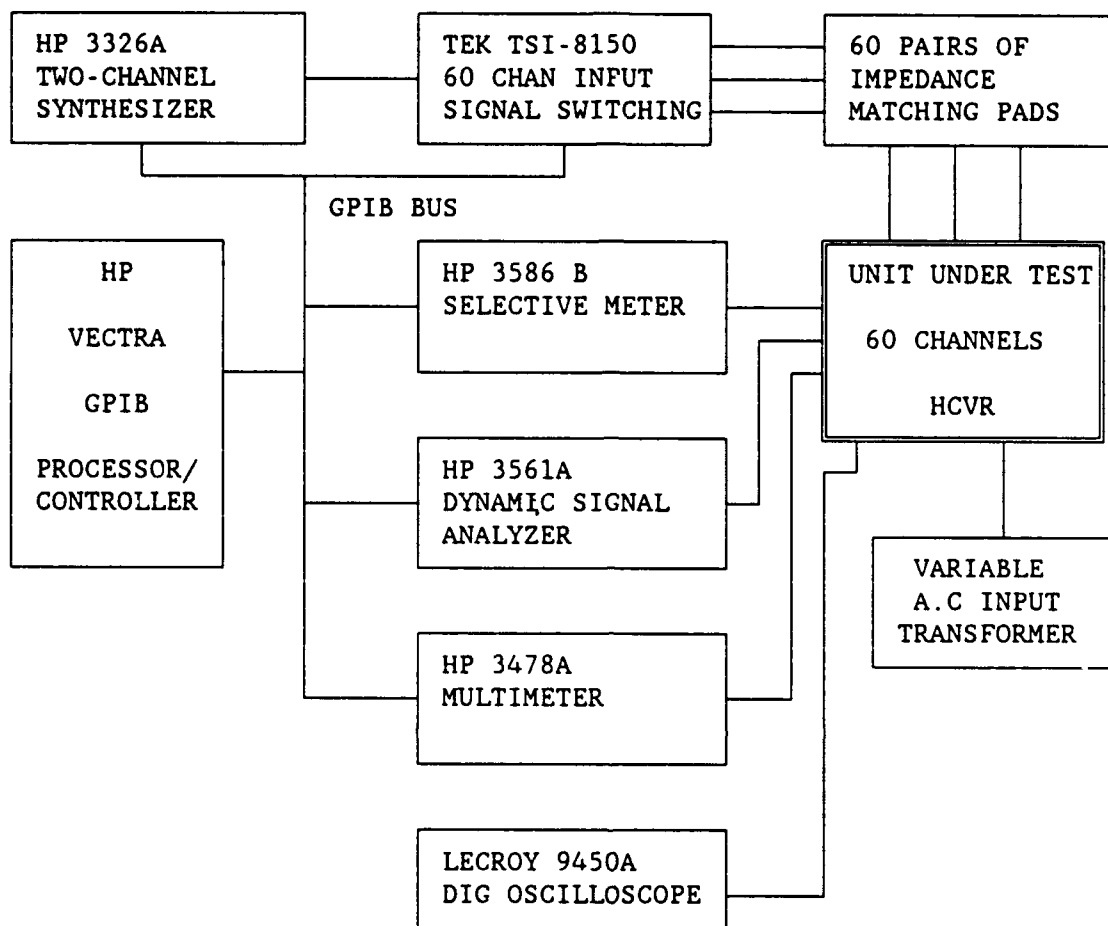


FIGURE 1. UNIT LEVEL TEST CONFIGURATION

The test configuration shown in figure 1 was used to verify the following FAA-P-2878 requirements:

- 3.3.14 Frequency Response
- 3.3.15 Harmonic Distortion
- 3.3.16 Signal-to-Noise
- 3.3.17 Crosstalk
- 3.3.18 Hum Distortion

Unit level tests were conducted on the following Magnasync Units:

- a. Dual Transport Tape Recorder/Reproducer Unit
- b. Portable Tape Reproducer Unit, Dual Cassette Recorder/Reproducer
- c. Degausser Unit

The test configuration for each of these tests is provided in the HCVR-NAS System Performance Test Procedures prepared by ACW-400A.

### 3.1.1 Unit Level Test Results.

The FAA-P-2878 for the HCVR lists 85 requirements; 67 of these were verified by these tests; 14 requirements failed; and 4 could not be verified because manufacturer's data was not available. Appendix A lists these requirements and indicates the test status of each requirement.

There were three separate failures of a transformer on the record amplifier boards which was of a concern. This was considered a component failure and not a failure of a FAA-P-2878 requirement.

The FAA-P-2878 requirements which failed are listed below by categories:

#### Failed Requirements

#### Failure

3.3.8	START TIME	0.9 SECONDS VS 0.5 SECONDS
3.3.10	TRANSPORT SENSORS	ONLY END-OF-TAPE (EOT) SENSOR PROVIDED. MOTION SENSING IS OBTAINED FROM TACH CKT SYNCHRONIZED TO MOTOR DRIVE. THIS PROVIDES EOT & TAPE BREAKAGE SENSING. TAPE TRANSPORT DOES NOT STOP AND CONTINUES TO REEL THE LOOSE END OF THE TAPE ONTO THE FLOOR.
3.3.12	INPUT LEVELS	MANUAL CHANGE OF JUMPERS REQUIRED
3.3.20	HEAD ASSEMBLY	WARRANTY 3 YRS, RQMT 11.4 YRS
3.3.22	SWITCHING CIRCUITRY	FAA-P-2878 REQUIRES NO TRANSFER OF RECORDING WITH PWR SUPPLY FAILURE. RECORDER TRANSFERRED RECORDING WITH PWR SUPPLY FAILURE (MODULE REMOVED).
3.3.23	MONITOR & ALARM	TAPE BREAKAGE BETWEEN CAPSTAN AND TAKE-UP REEL WILL NOT SOUND ALARM.

3.3.26.2	ACCESSIBILITY	OVERLOAD PROTECTION DEVICES NOT ON FRONT PANEL
3.4.1	PORTABLE REPRODUCER UNIT	PWR SUP & CONTROL PANEL NOT FULLY COMPATIBLE
3.4.1.1	DESIGN & CONSTRUCTION	HEIGHT 8" OVER SPEC (34")
3.4.1.5	FOOT CONTROL PANEL	AUTO-SEARCH NOT PROVIDED
3.4.1.7	TWO CHANNEL CASSETTE RECORDER	COULD NOT BE TESTED FOR IRIG FUNCTION. <u>ECP IN PROCESS TO MOD MASTER SYNCHRONIZER TO CORRECT PROBLEM.</u>
3.4.1.9	AUDIO TIME JACK	(SAME COMMENT AS FOR 3.4.1.7)
3.4.2.10	STOP FUNCTION	NO AUTO STOP <u>AND</u> EJECT (ONLY AUTO STOP)
3.4.4.4	DEGAUSSER CYCLE	DOES NOT MEET TIME AT LOW VOLTAGE

Note: Although these are specification requirements, this acquisition was a COTS buy, and all of these items were as provided by the Contractor.

#### Manufacturer Data Not Available

3.3.5.1	TAPE-PHYSICAL PROP.	DATA NOT AVAILABLE FROM MANUFACTURER.
3.3.26.5	SERVICE LIFE	DATA NOT PROVIDED BY MANUFACTURER.
3.5	MAINTAINABILITY & RELIABILITY	DATA NOT AVAILABLE FROM MANUFACTURER.
3.6	TEST TAPE	NOT PROVIDED BY MANUFACTURER.

NAS-SS-1000, Volume I, Section 6, page 106, defines Critical as "Functions or services that, if lost, would prevent the NAS from exercising safe separation and control over aircraft." Based on this definition, all of the failed requirements listed above are considered non-critical and would not prevent a deployment recommendation of the HCVR equipment.

#### 3.2 DROP-OUT TESTS.

During Shakedown testing by ASM-640, loss of signal for short periods of time were noted (drop-outs). A drop-out was defined as a depression in the signal level for a period of time. This time was approximately 150 milliseconds (ms). Drop-out tests were conducted at the FAA Technical Center to verify test results obtained by ASM-640. The test scenario involved recording a 2000-hertz (Hz) audible tone using one of the recorder transports and reproducing it on the playback unit.

Additional tests were conducted using prerecorded tapes with ANSI standard word lists and with air traffic control (ATC) expressions. Six different word lists containing more than 300 words and 13 sentences spoken by different air traffic controllers were used for this test. Pauses were inserted to simulate drop-outs. These pauses varied in duration from 70 to 160 ms. The pause was randomly inserted on different syllables at the beginning, middle, and end of the word. Only one or two drop-outs were inserted in the sentences. Listeners were permitted to replay the tape as many times as they wished to hear the word. After hearing the tapes with drop-outs, the listeners were given tapes with the same word list, without drop-outs. The test data was analyzed for duration of drop-out, location of drop-out within the word, and the type of syllable containing the drop-out.

It should be noted that these tests were performed in the ACW-400A laboratory and limited by the availability of test equipment. In addition, the test tapes were played back on the Technics Dual Cassette Recorder provided with the Magnasync Recorder. This added another variable into the test.

### 3.2.1 Drop-out Test Results.

Tests performed on the Magnasync and Dictaphone tape recorders showed the Magnasync to have 24 drop-outs during 240 minutes of recording and the Dictaphone to have only 11 drop-outs for the same recording period. The lower drop-outs in the Dictaphone are attributed to having two capstans rather than one in the Magnasync. Detailed test results are available from ACW-400A.

Results from the prerecorded tape tests indicated an average of 10-20 percent of all words on the tapes with drop-outs were misinterpreted. The controller's sentences which contained one to two drop-outs per sentence were all interpreted correctly. A drop-out of greater than 100 ms at the beginning of the word had the most effect on the intelligibility of the word. This duration drop-out had less of an effect on multisyllable words. Test data sheets are available from ACW-400A.

### 3.3 AUDIO INPUT LEVEL TESTS.

These tests were conducted because of the problem encountered during initial OT&E Integration tests at the Seattle ARTCC. The signal level for input from air traffic controllers was measured at -37 decibels above 1 milliwatt (dBm) and audio input from the pilots at +5 dBm. The dynamic range of the recorders is 35 decibel (dB). This resulted in the tape recorder clipping the audio from the pilot since their input level was set above at -10 dBm. These tests were to determine the effect of the peak limiter circuit on the Record Board. A block diagram of the test configuration is shown in figure 2. The test was conducted over the full dynamic operating range of the recorder (35 dB). The input signal to the Record Board was varied from -51.2 dBm to +3.81 dBm (the maximum output of the Hewlett Packard (HP) Signal Generator), at three calibrated tap settings; -10 decibels above 1 millivolt (dBv), 0 dBv and +10 dBv. The output was measured at the Record Amplifier output, with and without the peak limiter circuit.

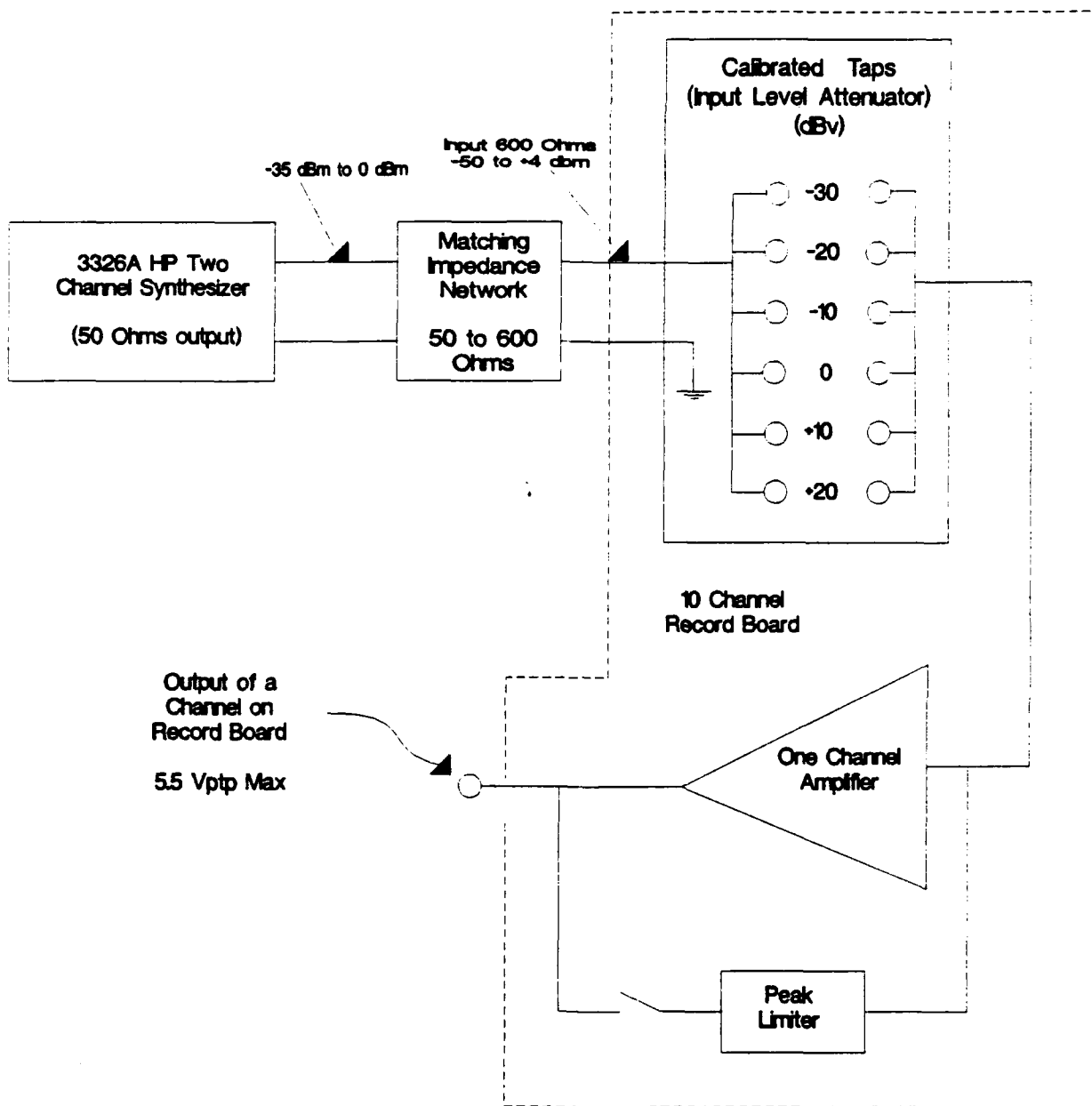


FIGURE 2. AUDIO INPUT LEVEL TEST

### 3.3.1 Audio Input Level Test Results.

A plot of the output data is provided in figure 3 and the measured data tabulated in appendix D. Figure 3 clearly shows the point at which the peak limiter comes into effect (at an output voltage of about 1.7 volts, far below the 5.5 volt saturation level). The peak limiter comes into effect at an input level of -13.2 dBm for the calibrated tap setting of -10 dBv and -3.19 dBm for the calibrated tap setting of 0 dBv. The level at which the peak limiter comes into effect for the calibrated tap setting of +10 dBm could not be determined because of limitations in the test equipment.

## 4. OT&E INTEGRATION TESTS AT KEY SITE.

Tests at the key site in Seattle had the following specific purposes:

- a. Verify NAS-SS-1000, Volume I, System Level Requirements that could not be verified at the FAA Technical Center, and
- b. Verify NAS-SS-1000, Volume IV Subsystem Level Requirements that could not be verified at the FAA Technical Center.

### 4.1 SYSTEM LEVEL REQUIREMENTS VERIFICATION TEST.

The purpose of these tests was to verify those NAS-SS-1000, Volume I, System Level Requirements applicable to the HCVR equipment. A total of 17 requirements are listed in appendix B. Seven of these are considered nonapplicable (N/A) because they are lead-in paragraphs or they do not specifically apply to the HCVR.

#### 4.1.1 System Level Test Results.

Initial tests were mechanical alignment tests of the tape recorder/reproducer and limited recording tests on selected channels. A source of input signals for all channels was not available at the test site.

There was a failure of a transformer on the Record Board, but this was considered a component failure and not the failure of a function.

All ten of the applicable system level requirements were successfully completed.

### 4.2 SUBSYSTEM LEVEL REQUIREMENTS VERIFICATION TEST.

The purpose of these tests was to verify those NAS-SS-1000, Volume IV, Subsystem Level Requirements applicable to the HCVR equipment. A total of 56 requirements are listed in appendix C. Fifteen of these are considered N/A because they are lead-in paragraphs or they do not specifically apply to the HCVR.

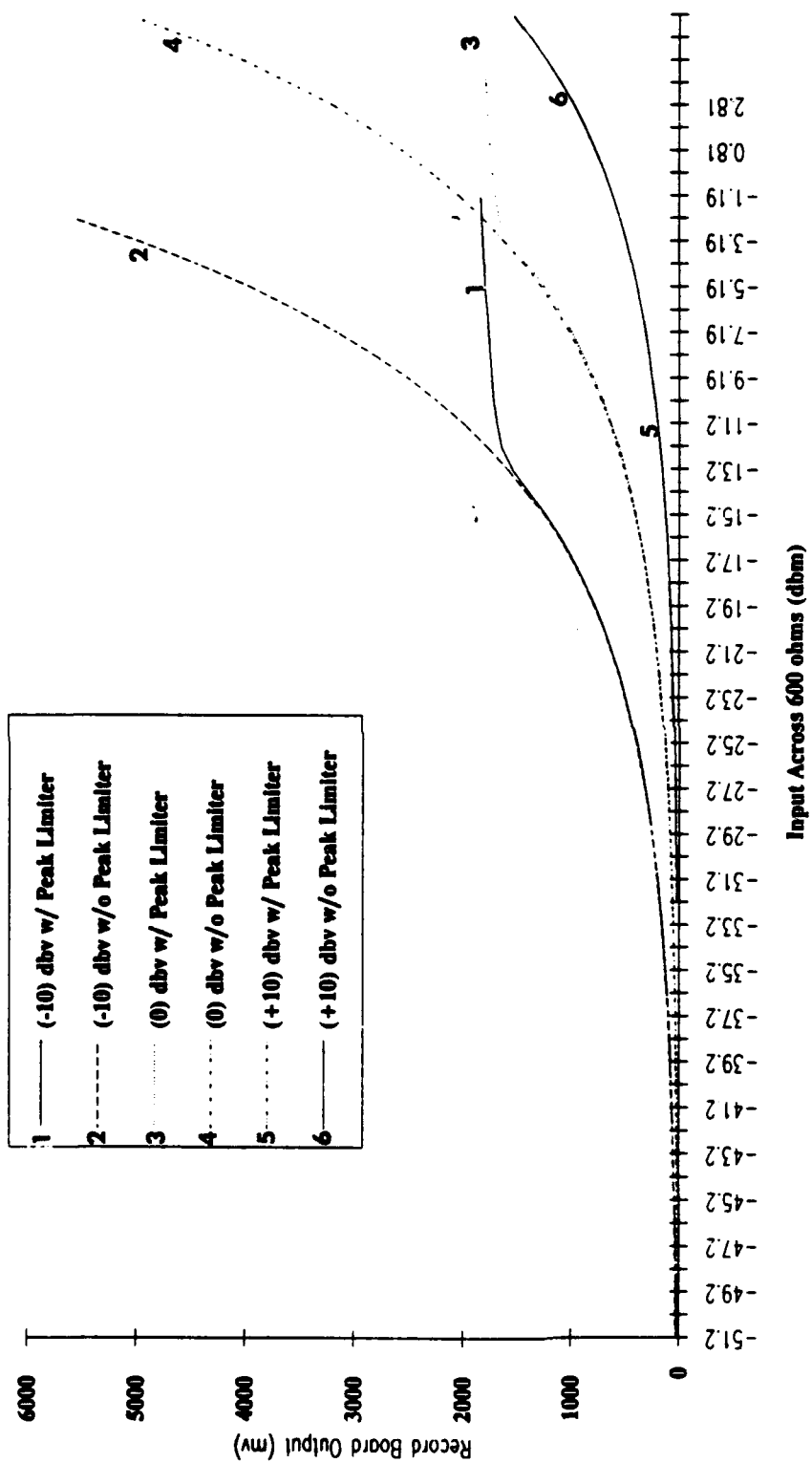


FIGURE 3. PLOT OF PEAK LIMITER OUTPUT DATA

#### 4.2.1 SUBSYSTEM LEVEL TEST RESULTS.

Twenty-nine NAS-SS-1000, Volume IV, Subsystem Level Requirements were successfully verified. Twelve requirements failed during testing at the Seattle ARTCC and are listed below:

<u>Paragraph No.</u>	<u>Requirement Description</u>
3.2.1.2.5.1.3.2.b	Media runs out - Tape breakage, after the capstan, and record conditions will not activate alarm.
3.2.1.2.5.1.3.2.c	Media fails - Tape breakage, after the capstan, and record conditions will not activate alarm.
3.2.1.2.5.1.3.2.d	Failure of the media remaining sensor - Certain tape breakage and record conditions will not activate alarm.
3.2.1.2.5.1.3.2.e	Any condition that actuates the shutdown system - Certain tape breakage and record conditions will not activate alarm.
3.2.1.2.5.1.3.2.f	Failure of the record function in the operating recorder - Certain tape breakage and record conditions will not activate alarm.
3.2.1.2.5.1.3.3.a	Any of the conditions which cause main to standby recorder switching except when the media on the operating recorder reaches the adjusted sensing point - Certain tape breakage and record conditions will not activate alarm.
3.2.1.2.5.1.3.3.b	Failure of any power supply module - Certain tape breakage and record conditions will not activate alarm.
3.2.1.2.5.1.3.3.c	Loss of time code signal recording - Contractor provides no alarm for loss of time code.
3.2.1.2.5.1.6	Erasing equipment - The erasing equipment shall provide for erasure of media - Degausser takes 64 seconds at low AC voltage (105 volts).
3.2.1.2.5.2.2.1	Input levels - The record system shall record all audio signals from -35 dBm to 0 dBm - Failure due to manual change of jumpers to select levels.



3.2.1.2.5.2.2.4

Availability - The recording equipment shall meet an availability of .999 - Data not available from contractor.

3.2.1.2.5.2.5

Erasing equipment - The total erasure time shall not exceed 50 seconds - Degausser takes 64 seconds at low AC voltage (105 volts).

## 5. CONCLUSIONS.

ACW-400A conclusions from the Federal Aviation Administration (FAA) Technical Center tests and key site tests are discussed in the following paragraphs.

### 5.1 UNIT LEVEL TEST CONCLUSIONS.

All of the failures obtained on the unit tests are considered noncritical. In addition, some of the failures were due to the contractor's equipment not meeting specification requirements because of their equipment design. This was a Commercial Off-The-Shelf (COTS) acquisition. The equipment was not specifically designed to meet the FAA-P-2878 requirements.

### 5.2 DROP-OUT TEST CONCLUSIONS.

Drop-outs of 70 to 160 milliseconds (ms) will not have a significant impact on detecting information recorded on tape.

### 5.3 PEAK LIMITER TEST CONCLUSIONS.

The sites will have to adjust the input levels to the recorder to prevent saturation of the signal, without a peak limiter.

The sites need not be concerned about the input level and leave them set at their present levels, with a peak limiter.

### 5.4 OT&E INTEGRATION TEST CONCLUSIONS.

Test conclusions for the two areas of test comprising Operational Test and Evaluation (OT&E) Integration are discussed in the following paragraphs.

#### 5.4.1 SYSTEM LEVEL TEST CONCLUSIONS.

One failure, noted during OT&E Integration, is the failure of a transformer on the Record Board. This could cause a failure of the tone signal that would be difficult to detect unless each channel of the recorder was checked separately.

#### 5.4.2 SUBSYSTEM LEVEL TEST CONCLUSIONS.

The subsystem level requirements which failed are considered noncritical and would not prevent a recommendation to deploy the HCVR equipment. Some of the failures are due to the equipment being COTS and the contractor did not provide some of the features required by the FAA-P-2878.

## 6. RECOMMENDATIONS.

ACW-400A recommends deployment of the High Capacity Voice Recorder (HCVR) equipment under the following conditions:

a. All channels on the recorder be tested each time a tape is changed. This will prevent the failure of the transformer on the Record Board causing an undetectable failure of the tone signal and ensure that all channels are operating properly.

b. Peak limiters be supplied on all Record Boards. This will provide greater flexibility for operating with different signal levels. (Peak limiters are presently installed on the 152-channel voice recorders).

c. The program office to provide an acceptable interface for the master synchronizer Coded Time Source (CTS) input.

d. ACW-400A recommends that the National Airspace System (NAS) Change Proposal (NCP) to waive the NAS-SS-1000 Total Harmonic Distortion voltage (THDv) requirement be approved before deployment.

## 7. ACRONYMS AND ABBREVIATIONS.

a-g	air-to-ground
AGC	Automatic Gain Control
ANSI	American National Standard Institute
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
COTS	Commercial-Off-The-Shelf
CTS	Coded Time Source
dB	decibel
dBm	decibels above 1 milliwatt
dBv	decibels above 1 millivolt
ECP	Engineering Change Proposal
EOT	End of Tape
FAA	Federal Aviation Administration
g-g	ground-to-ground
HCVR	High Capacity Voice Recorder
HP	Hewlett Packard
Hz	hertz
IRIG	Inter-Range Instrumentation Group
ms	milliseconds
NAS	National Airspace System
NCP	National Airspace System (NAS) Change Proposal
OT&E	Operational Test and Evaluation
THDv	Total Harmonic Distortion voltage
TRACON	Terminal Radar Approach Control Facility
VRTM	Verification Requirements Traceability Matrix

**APPENDIX A**

**FAA-P-2878 VERIFICATION REQUIREMENTS AND FINAL REPORT TRACEABILITY MATRIX**

FAA-P-2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL	UNIT		NOTES	
3.3.1	TRANSPORTS OPERATION FEATURES RECORD CAPACITY MODULE ISOLATION	A	PASS	1.1.1		
3.3.1.1		D	PASS	1.1.2		
3.3.1.2		D	PASS	1.1.3		
3.3.2		D	PASS	1.1.4		
3.3.3		D	PASS	1.1.5		
3.3.4	TAPE SPEED RECORDING TAPE TAPE - PHYSICAL PROPERTIES TAPE - MAGNETIC PROPERTIES TAPE - ELECTROMAGNETIC PROPERTIES	T	PASS	1.1.6	1	
3.3.5		A	PASS	1.1.7	2	
3.3.5.1		A	NOT AVL	1.1.7.1	3	
3.3.5.2		A	PASS	1.1.7.2		
3.3.5.3		A	PASS	1.1.7.3		
3.3.6	BRAKING SYSTEM FAST - FORWARD/REWIND TIME START TIME STOP TIME TRANSPORT SENSORS	D	PASS	1.1.8	4	
3.3.7		T	PASS	1.1.9	5	
3.3.8		T	FAIL	1.1.10	6	
3.3.9		T	PASS	1.1.11		
3.3.10		D	FAIL	1.1.12	7	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 - WARRANTY INFORMATION WAS OBTAINED FROM AMPEX (TAPE MANUFACTURE), AND NOT MAGNASYNC

2 - YIELD, BREAKING AND HEAD WEAR INFORMATION NOT AVAILABLE FROM MANUFACTURE

3 - REMENANCE INFORMATION IS PROPORTIONAL TO RETENTIVITY WHICH PASSED

4 - BREAK MECHANISM DOES NOT ENGAGE IF TAPE BREAKS AFTER CAPSTAN

5 - LACK OF CONTACT BETWEEN THE RECORDING HEAD AND THE TAPE COULD NOT BE VERIFIED

6 - START-TIME FROM STOP TO STABLE RECORD-SIGNAL IS 995 MS ON TRA. A AND 912 MS ON TRA. B

7 - ONLY END OF TAPE SENSOR IS INSTALLED

FAA - P - 2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL			UNIT	NOTES
3.3.11	DUAL ELECTRONIC PACKAGE INPUT LEVELS INPUT IMPEDANCE FREQUENCY RESPONSE	D		1.1.13	PASS	1
3.3.12		T		1.1.14	FAIL	
3.3.13		A		1.1.15	PASS	
3.3.14		T		1.1.16	PASS	
3.3.15	HARMONIC/INTERMODULATION DISTORTION SIGNAL TO NOISE CROSSTALK HUM DISTORTION	T		1.1.17	PASS	
3.3.16		T		1.1.18	PASS	
3.3.17		T		1.1.19	PASS	
3.3.18		T		1.1.20	PASS	
		T		1.1.21	PASS	
3.3.19	RECORD AMPLIFIER HEAD ASSEMBLY POWER SUPPLY SYSTEM DUAL POWER SUPPLY POWER SUPPLY - FUSES	A		1.1.22	PASS	2
3.3.20		A		1.1.23	FAIL	
3.3.21		T		1.1.24	PASS	3
3.3.21.1		A		1.1.25	PASS	
3.3.21.2		A		1.1.26	PASS	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

- NOTES: 1 - MANUAL CHANGING OF JUMPERS NEEDED TO SELECT INPUT LEVELS FROM +20 dBm TO -30 dBm  
2 - HEAD WEAR INFORMATION INDICATES WARRANTY FOR 3 YEARS, FAA-P-2878 REQ. 11.4 YEARS.  
3 - SEE CONTRACT AMENDMENT 001 DATED 5-20-91 QUESTION (2).

FAA - P - 2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL			UNIT	NOTES
3.3.21.3	BATTERY BACKUP SWITCHING CIRCUITRY MONITOR AND ALARM CHANNEL MONITOR REMOTE INDICATOR	D		1.1.27	PASS	1
3.3.22		D		1.1.28	FAIL	2
3.3.23		D		1.1.29	FAIL	
3.3.23.1		D		1.1.30	PASS	
3.3.23.2		D		1.1.31	PASS	
3.3.24.1	TAPE SEARCH AUTOMATIC TAPE SEARCH MANUAL TIME/DATE GENERATOR DIGITAL TIME CODE AUXILIARY TIME SIGNAL OUTPUT	D		1.1.32	PASS	3
3.3.24.2		D		1.1.33	PASS	
3.3.25		D		1.1.34	PASS	
3.3.25.1		D		1.1.35	PASS	
3.3.25.2		T		1.1.36	PASS	
3.3.26	DESIGN AND CONSTRUCTION RECORDER/REPRODUCER CABINET ACCESSIBILITY CABLES POWER CABLES	A		1.2.1	PASS	4
3.3.26.1		A		1.2.2	PASS	
3.3.26.2		A		1.2.3	FAIL	
3.3.26.3		A		1.2.4	PASS	
3.3.26.3.1		A		1.2.4.1	PASS	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE  
PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 - DOES NOT MEET SPECIFICATION DUE TO POWER SUPPLIES CONFIGURATION AS IN NOTE 3.  
2 - CERTAIN TAPE BREAKAGE AND RECORD CONDITION WILL NOT ACTIVATE ALARM.  
3 - DIGITAL TIME CODE PASSED PD REQUIREMENT, BUT WILL REQUIRE ADAPTATION TO IRIG-E (600 Hz).  
4 - OVERLOAD PROTECTIVE DEVICES ARE NOT ON FRONT PANEL.

FAA-P-2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL			UNIT	NOTES
3.3.26.3.2	AUDIO CABLES CHASSIS EQUIPMENT SERVICE LIFE INTERFERENCE WARMUP TIME	A		1.2.4.2	PASS	1
3.3.26.4		A		1.2.5	PASS	
3.3.26.5		A		1.2.6	NOT AVL	
3.3.26.6		A		1.2.7	PASS	
3.3.26.7		D		1.2.8	PASS	
3.3.27	REMOTE INDICATOR DESIGN AND CONSTRUCTION VISUAL INDICATORS AURAL ALARM POWER REQUIREMENTS	D		1.2.9	PASS	
3.3.27.1		A		1.2.9.1	PASS	
3.3.27.2		D		1.2.9.2	PASS	
3.3.27.3		D		1.2.9.3	PASS	
3.3.27.4		D		1.2.9.4	PASS	
3.4	PORTABLE REPRODUCER SYSTEM PORTABLE REPRODUCER UNIT DESIGN AND CONSTRUCTION TAPE DECK TAPE HEAD ASSEMBLIES	N/A		N/A	N/A	2
3.4.1		D		2.1.1	FAIL	3
3.4.1.1		D		2.1.2	FAIL	4
3.4.1.2		D		2.1.3	PASS	
3.4.1.3		D		2.1.4	PASS	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 - DATA NOT PROVIDED BY MANUFACTURER.

2 - THIS PARAGRAPH IS A LEAD-IN AND DOES NOT CONTAIN A TEST.

3 - FAIL DUE TO POWER SUPPLY AND CONTROL PANEL ARE NOT FULLY COMPATIBLE.

ALSO IRIG-E NOT AVAILABLE FOR TESTING.

4 - OVERALL HEIGHT IS 42", 8" OVER THE SPECIFIED 34".

FAA - P - 2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL	UNIT		NOTES	
3.4.1.4	ELECTRONIC CIRCUITS FOOT CONTROL ASSEMBLY EARPHONE JACK TWO CHANNEL CASSETTE RECORDER AUDIO OUTPUT JACK	D		2.1.5	PASS	1
3.4.1.5		D		2.1.6	FAIL	
3.4.1.6		D		2.1.7	PASS	2
3.4.1.7		D		2.1.8	FAIL	
3.4.1.8		D		2.1.9	PASS	
3.4.1.9	AUDIO TIME JACK OPERATION FEATURES METERS REWIND OPERATION	D		2.1.10	FAIL	3
3.4.2.1		D		3.1.1	PASS	
3.4.2.2		D		3.1.2	PASS	
3.4.2.3		D		3.1.3	PASS	
3.4.2.4		D		3.1.4	PASS	
3.4.2.5	MANUAL SEARCH AUTO SEARCH C TYPE FORMAT RECORD FUNCTION AGC	D		3.1.5	PASS	
3.4.2.6		D		3.1.6	PASS	
3.4.2.7		A		3.1.7	PASS	
3.4.2.8		D		3.1.8	PASS	
3.4.2.9		A		3.1.9	PASS	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE

PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 - AUTO-SEARCH IS NOT PROVIDED FOR FOOT CONTROL.

2 - TWO CHANNEL CASSETTE RECORDER COULD NOT BE TESTED FOR IRIG-E FUNCTIONS.

3 - AUDIO JACK IS PROVIDED, IRIG-E COULD NOT BE TESTED.



FAA - P - 2878 PARAGRAPH NUMBER	REQUIREMENT DESCRIPTION	VERIFICATION METHODS		UNIT TEST PROCEDURE PARAGRAPH NUMBER	TEST STATUS	
		UNIT LEVEL			UNIT	NOTES
3.4.2.10	STOP FUNCTION	D		3.1.10	FAIL	1
3.4.2.11	TIME FUNCTION	D		3.1.11	PASS	
3.4.3	POWER REQUIREMENTS	T		3.1.12	PASS	
3.4.4	TAPE DEGAUSSER UNIT	N/A		N/A	N/A	
3.4.4.1	TAPE CONDITIONING	D		4.1.1	PASS	
3.4.4.2	TAPE REELS	D		4.1.2	PASS	2
3.4.4.3	AUTOMATIC OPERATION	D		4.1.3	PASS	
3.4.4.4	DEGAUSSER CYCLE	D		4.1.4	FAIL	
3.4.4.5	POWER REQUIREMENTS	T		4.1.5	PASS	
3.4.4.6	PHYSICAL CHARACTERISTICS	A		4.1.6	PASS	
3.5	MAINTAINABILITY AND RELIABILITY	A		5.1	NOT AVL	3
3.6	TEST TAPE	N/A		5.2	NOT AVL	4

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE  
PASS - PASSED, MEETS REQUIREMENT WITHOUT COMMENT

NOTES: 1 - AUTOMATIC STOP BUT NOT AUTOMATIC STOP AND EJECT.  
2 - DEGAUSSER, MEETS REQ. AT 120V & 130V BUT AT 105 TIME WAS 64 sec.  
3 - INFORMATION NOT AVAILABLE.  
4 - TEST TAPE NOT AVAILABLE.

**APPENDIX B**

**NAS-SS-1000 VOLUME I, SYSTEM LEVEL REQUIREMENTS**

NAS-SS-1000 VOL. I REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.1.8.1.1.c	Data Comm. - NAS network shall provide, flexibility to enable growth for future data communications requirements	-----	A		*	N/A	P	
3.2.1.1.8.1.1.d	Data Comm. - Independent emergency data comm. between ACF, ATCT, AFSS, ATCCC, maintenance facilities, regional offices.	-----	N/A	N/A	N/A	N/A	N/A	
3.2.1.1.8.1.3	Data & voice archiving - The NAS shall provide data & voice recording & playback capability for archiving & reconstruction purposes.	3.3.1 3.3.2	D D D D D D	* * * *	* *	5.5-101 5.5-102 5.5-103 5.5-104 5.4-103 5.4-103	P P P P P P	
3.2.1.1.8.2	NAS Time Standard - The NAS shall provide a standard time signal for all NAS subsystems	-----	N/A	N/A	N/A	L.I	N/A	
3.2.1.1.8.2.a	NAS Time Standard - Means for synchronizing with a master time clock	3.3.25 3.3.25.1 3.3.25.2	D D D T	* * *	*	5.4-112 1.1.34 1.1.35 1.1.36	P P P P	

VERIFICATION Methods: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NAS-SS-1000 VOL. I REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE				
3.2.1.1.8.2.b	NAS time standard - Means for interfacing NAS subsystem having their own time standard and/or synchronization capabilities with other NAS subsystems requiring these capabilities.	-----	D		*		5.4-112	P	
3.2.1.2.8.3	Data & voice archiving perform. characteristics- The NAS shall provide data and voice storage recording and playback capability for reconstruction purposes.	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.8.3.a	Record all specified operational voice and data information for support of analysis.	3.3.1.1	D D	*	*		5.4-103 1.1.2	P P	
3.2.1.2.8.3.b	Retrieve and playback all specified recorded data and voice information requested by an authorized specialist.	-----	N/A	N/A	N/A		L.I	N/A	

VERIFICATION Methods: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NAS-SS-1000 VOL. I REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE				
3.2.1.2.8.3.b.1	Voice recording retrieval within 30 minutes from on-line storage and within 60 minutes from off-line storage.	3.3.24.1 3.3.24.2 3.4.2.5 3.4.2.6	D D D D	*	*		5.4-111 1.1.32 3.1.5 3.1.6	P P P P	
3.2.1.2.8.3.b.2	Data recordings retrievable from off-line storage	3.3.5	A	*			1.1.7	P	
3.2.1.2.8.3.c	Store all operational data and voice recordings in accordance with appropriate FAA procedures.	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.8.3.c.1	Voice transmission, 15 days min.	-----	A		*		-----	P	1
3.2.1.2.8.3.c.2	Data information, 15 days min.	-----	N/A	N/A	N/A		N/A	N/A	
3.2.1.2.8.4	NAS time standard performance characteristics. - The NAS shall provide a standard time signal.	-----	N/A	N/A	N/A		L.I	N/A	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NOTES: (1) This is the normal operating procedures for FAA ARTCC's.

NAS-SS-1000 VOL. I REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.8.4.b	A system dealing with non-ATC functions shall be synchronized to within 6 seconds of UTC.	-----	T D D		*	5.2-101 5.4-104 5.4-112	P P P	
3.2.1.2.8.4.c	The NAS shall provide interfacing capabilities to the coded time signal and synchronization in accordance with Vol. II-V of NAS-SS-1000.	-----	D		*	5.4-112	P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

**APPENDIX C**

**NAS-SS-1000 VOLUME IV, SUBSYSTEM LEVEL REQUIREMENTS**

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.5	Recording Equipment-Multichannel recording equipment will provide the legal recording of voice comm. involving air traffic control activities. The recording equip. will consist of the record and reproduce systems, duplica. equip. and erasing equipment.	-----	N/A	N/A	N/A	L.I	N/A	
3.2.1.2.5.1	Functional characteristics - The recording equipment shall provide the following function:	-----	N/A	N/A	N/A	L.I	N/A	
3.2.1.2.5.1.1	Time - The recording equipment shall record time code that is synchronized with an external time source or its own CTS.	3.3.25.1	D	*		5.5-104	P	
3.2.1.2.5.1.2	Record & reproduce system - The record and reproduce system shall provide the following:	-----	N/A	N/A	N/A	L.I	N/A	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site



NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATÇ	SEATTLE				
3.2.1.2.5.1.2.1	Media sensor - Each recorder shall provide:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.2.1.a	End of media sensor	3.3.10	D		*		5.4-110	P	
3.2.1.2.5.1.2.1.b	Media failure sensor	-----	D		*		5.1-109	P	
3.2.1.2.5.1.2.1.c	Adj. media remaining sensor	-----	N/A	N/A	N/A		-----	N/A	
3.2.1.2.5.1.2.2	Shutdown system - Each recorder shall be designed to stop automatically in the event of:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.2.2.a	A power failure	3.3.6	D	*			1.1.8	P	
3.2.1.2.5.1.2.2.b	Media failure	-----	D		*		5.1-109	P	
3.2.1.2.5.1.2.2.c	End-of-media detection	3.3.10	D		*		5.4-110	P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE				
3.2.1.2.5.1.3	Record system - The record system shall provide the following functions:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.3.1	Dual recorders - The record system shall provide a:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.3.1.a	Operating recorder;	3.3.1	A D	*	*		5.4-103	P P	
3.2.1.2.5.1.3.1.b	Standby recorder	3.3.1	A D	*	*		5.4-103	P P	
3.2.1.2.5.1.3.2	Main/standby recorder switching - The record system shall auto. place the standby recorder into operat. when the following occurs	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.3.2.a	Media remaining on the operating recorder reaches the adjusted sensing point;	-----	D		*		5.1-109	P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.5.1.3.2.b	Media runs out;	3.3.23	D	*		1.1.29	F	1
3.2.1.2.5.1.3.2.c	Media fails;	3.3.23	D	*		1.1.29	F	1
3.2.1.2.5.1.3.2.d	Failure of the media remaining sensor;	3.3.23	D	*		1.1.29	F	1
3.2.1.2.5.1.3.2.e	Any condition that actuates the shutdown system;	3.3.23	D	*		1.1.29	F	1
3.2.1.2.5.1.3.2.f	Failure of the record function in the operating recorder.	3.3.23	D	*		1.1.29	F	1
3.2.1.2.5.1.3.3	Alarms - The following conditions shall cause an alarm to be generated:	-----	N/A	N/A	N/A	L.I.	N/A	
3.2.1.2.5.1.3.3.a	Any of the conditions which cause main to standby recorder switching except when the media on the operating recorder reaches the adjusted sensing point;	3.3.23	D D	*	*	5.4-109 1.1.29	P F	1

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NOTE: (1) Certain tape breakage and record conditions will not activate an alarm.

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE				
3.2.1.2.5.1.3.3.b	Failure of any power supply module;	3.3.23	D	*			1.1.29	F	1
3.2.1.2.5.1.3.3.c	Loss of time code signal recording;	3.3.23	D	*			1.1.29	F	2
3.2.1.2.5.1.3.3.d	Record malfunction	3.3.23	D	*	*		5.4-109	P	
3.2.1.2.5.1.3.4	Channel monitor - Channel monitoring shall not interfere with normal operations.	3.3.23.1	D	*			1.1.30	P	
3.2.1.2.5.1.4	Reproduction - The reproduction system shall provide;	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.1.4.a	Playback of a single channel	3.4.1	D	*	*		5.5-103	P	
3.2.1.2.5.1.4.b	Playback of at least two channels simultaneously.	3.4.1.7	D	*	*		5.4-103	P	
3.2.1.2.5.1.5	Duplicating equipment - The media duplication equipment shall record & reproduce at least two selected channels.	3.4.1 3.4.1.7	D D	*	*		5.5-104 5.5-104	P P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NOTES:

- (1) Certain tape breakage & record conditions will not activate an alarm.
- (2) Magnasync provides no alarm is case of loss of time code.

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS			HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE				
3.2.1.2.5.1.6	Erasing equipment - The erasing equipment shall provide for erasure of media.	3.4.4 3.4.4.1 3.4.4.4	D D D	*			4.1.1 4.1.1 4.1.4	P P F	1
3.2.1.2.5.2	Performance characteristics - The recording equipment shall meet the following performance characteristics:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.2.1	Record and reproduce system - The record and reproduce system shall meet the following performance characteristics:	-----	N/A	N/A	N/A		L.I	N/A	
3.2.1.2.5.2.1.1	Stop time - The system shall stop within 1 second after a stop command.	3.3.9	T	*			1.1.11	P	
3.2.1.2.5.2.1.2	Length of recording without changing media - A recording system shall record 24 hours before changing media.	3.3.1.1	D	*			1.1.2	P	
3.2.1.2.5.2.2	Record system - The record system shall meet the following performance characteristics:	-----	N/A	N/A	N/A		L.I	N/A	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NOTES: (1) DEGAUSSER, MEETS REQ. AT 120V & 130V, BUT AT 105 TIME WAS 64 sec (50 sec REQ.).

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.5.2.2.1	Input levels - The record system shall record all audio signals with a dynamic range from -35 dBm to 0 dBm.	3.3.12	T	*		1.1.14	F	1
3.2.1.2.5.2.2.2	Frequency response - The freq. response of each channel over the frequency range 300-3000 Hz shall not vary by more than 4 dB.	3.3.14	T	*		1.1.16	P	
3.2.1.2.5.2.2.3	Harmonic & intermodulation distortion- There shall be no distortion component greater than -34 dBm.	3.3.15 3.3.15	T T	* *		1.1.17 1.1.18	P P	
3.2.1.2.5.2.2.4	Availability - The recording equipment shall meet an availability of .999.	3.5	A	*		5.1	F	2
3.2.1.2.5.2.3	Reproduction - The reproduction system shall meet the following performance characteristics:	-----	N/A	N/A	N/A	L.I	N/A	
3.2.1.2.5.2.3.1	Frequency response - The freq. response of each channel over the frequency range 300-3000 Hz shall not vary more than 3 dB.	3.3.14	T	*		5.5-105	P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NOTES: (1) Magnasync uses jumpers which need to be installed manually.  
(2) Information not available.

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.5.2.3.2	Harmonic and intermodulation distortion - There shall be no distortion component that is greater than -34 dBm.	3.3.15 3.3.15	T T	*		5.5-106 5.5-107	P P	
3.2.1.2.5.2.3.3	Noise - The noise in each channel shall be at least 35 dB below a 0 dBm 1000 Hz record channel signal level.	3.3.16	T	*		5.5-109	P	
3.2.1.2.5.2.3.4	Crosstalk - No crosstalk signal component shall have an output level greater than -35 dBm at the repro. system monitor output.	3.3.17	T	*		5.5-108	P	
3.2.1.2.5.2.3.5	Hum distortion - The hum distortion produced in each channel shall not exceed -35 dBm with an input level of -15 dBm at 1000 Hz to the channel and an output level of 0 dBm at the reproduce system monitor output.	3.3.18	T	*		5.5-110	P	

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Site

NAS-SS-1000 VOL. IV REF. PARAGRAPH	REQUIREMENT DESCRIPTION	PURCHASE DESCRIPTION	VERIFICATION METHOD	TEST LOCATIONS		HCVR-NAS INTG/PERF PROCEDURE	P/F	NOTES
				FAATC	SEATTLE			
3.2.1.2.5.2.4	Duplicating equipment - The media duplicating equipment shall meet the following perfr. characteristic	-----	N/A	N/A	N/A	L.I	N/A	
3.2.1.2.5.2.4.1	Frequency response - The freq. response of each channel over the range 300-3000 Hz shall not vary by more than 4 dB.	3.3.14	T	*		5.5-111	P	
3.2.1.2.5.2.4.2	Crosstalk - The crosstalk in each channel shall be at least 35 dB below the channel signal level.	3.3.17	T	*		5.5-114	P	
3.2.1.2.5.2.4.3	Noise - The noise in each channel shall be at least 50 dB below the channel signal level.	3.3.16	T	*		5.5-115	P	
3.2.1.2.5.2.4.4	Harmonic distortion - There shall be no distortion component greater than -34 dBm.	3.3.15 3.3.15	T T	* *		5.5-112 5.5-113	P P	
3.2.1.2.5.2.4.5	Hum distortion - The hum distortion produced in each channel shall be at least 35 dB below signal level.	3.3.18	T	*		5.5-116	P	
3.2.1.2.5.2.5	Erasing equip. - The total erasure time shall not exceed 50 seconds.	3.4.4.4	D	*		4.1.4	F	1

VERIFICATION METHODS: T-TEST, D-DEMONSTRATION, A-ANALYSIS, I-INSPECTION, N/A-NOT APPLICABLE, LI-LEAD-IN, \*-Test Location

NOTES: (1) Degausser, meets req. at 120v & 130v, but at 105 was 64 sec. (50 sec. req.).



APPENDIX D  
PEAK LIMITER TEST RESULTS

INPUT to Pad dbm	INPUT to Circuit dbm	CH 2 OUT WITH LIM		CH 12 OUT NO LIM		CH 2 OUT WITH LIM		CH 12 OUT NO LIM		CH 2 OUT WITH LIM		CH 12 OUT NO LIM	
		(-) 10 dbm	mv	(-) 10 dbm	mv	(-) 10 dbm	mv	(-) 10 dbm	mv	(-) 10 dbm	mv	(-) 10 dbm	mv
-35	-51.19		20		24		10		10				
-34	-50.19		22		27		11		10				
-33	-49.19		25		28		12		11				
-32	-48.19		27		30		13		12				
-31	-47.19		30		34		12		12				
-30	-46.19		34		39		12		13				
-29	-45.19		40		40		13		17				
-28	-44.19		44		47		14		17				
-27	-43.19		50		50		17		18				
-26	-42.19		53		58		18		20				
-25	-41.19		63		65		20		22				
-24	-40.19		70		72		22		26				
-23	-39.19		78		80		25		27				
-22	-38.19		87		92		28		29				
-21	-37.19		99		100		32		31				
-20	-36.19		110		115		36		35				
-19	-35.19		124		130		40		41				
-18	-34.19		139		145		45		45				
-17	-33.19		156		158		50		52				
-16	-32.19		174		179		57		60		20	20	
-15	-31.19		196		200		64		65		21	20	
-14	-30.19		219		224		71		73		24	23	
-13	-29.19		246		250		80		84		27	27	
-12	-28.19		276		280		90		92		28	27	
-11	-27.19		310		316		100		102		33	32	
-10	-26.19		348		354		111		116		36	35	
-9	-25.19		3		395		126		129		39	40	
-8	-24.19		438		443		143		145		43	44	
-7	-23.19		489		499		159		162		51	53	
-6	-22.19		549		555		177		182		54	54	
-5	-21.19		621		626		200		202		63	64	

INPUT to Pad dbm	INPUT to Circuit dbm	CH 2 OUT WITH LIM		CH 12 OUT NO LIM		CH 2 OUT WITH LIM		CH 12 OUT NO LIM		CH 2 OUT WITH LIM		CH 12 OUT NO LIM	
		(-) 10 dbm	mv	(-) 10 dbm	mv	0 dbm	mv	0 dbm	mv	(+) 10 dbm	mv	(+) 10 dbm	mv
-4	-20.19		695		700		224		228		67		69
-3	-19.19		778		788		251		256		79		78
-2	-18.19		873		882		283		287		86		89
-1	-17.19		978		989		315		321		98		98
0	-16.19		1096		1108		355		361		110		108
1	-15.19		1231		1240		396		404		122		122
2	-14.19		1381		1410		443		456		138		138
3	-13.19		1540		1582		496		512		155		155
4	-12.19		1640		1774		560		572		174		173
5	-11.19		1682		1990		629		643		196		195
6	-10.19		1713		2226		705		721		219		218
7	-9.19		1730		2493		790		810		246		245
8	-8.19		1745		2800		887		906		275		275
9	-7.19		1760		3150		993		1015		310		307
10	-6.19		1777		3529		1113		1136		347		345
11	-5.19		1799		3945		1247		1272		388		386
12	-4.19		1800		4430		1403		1425		435		435
13	-3.19		1812		4965		1574		1609		487		488
14	-2.19		1825		5571		1661		1805		548		547
15	-1.19		1834				1700		2019		615		613
16	-0.19						1725		2270		690		688
17	0.81						1745		2540		776		771
18	1.81						1761		2850		870		863
19	2.81						1775		3183		973		968
20	3.81						1787		3575		1092		1088
21							1805		4007		1221		1222
22							1820		4494		1369		1368
23							1830		5051		1529		1531